The standard for sunlight readable switches.


SERIES

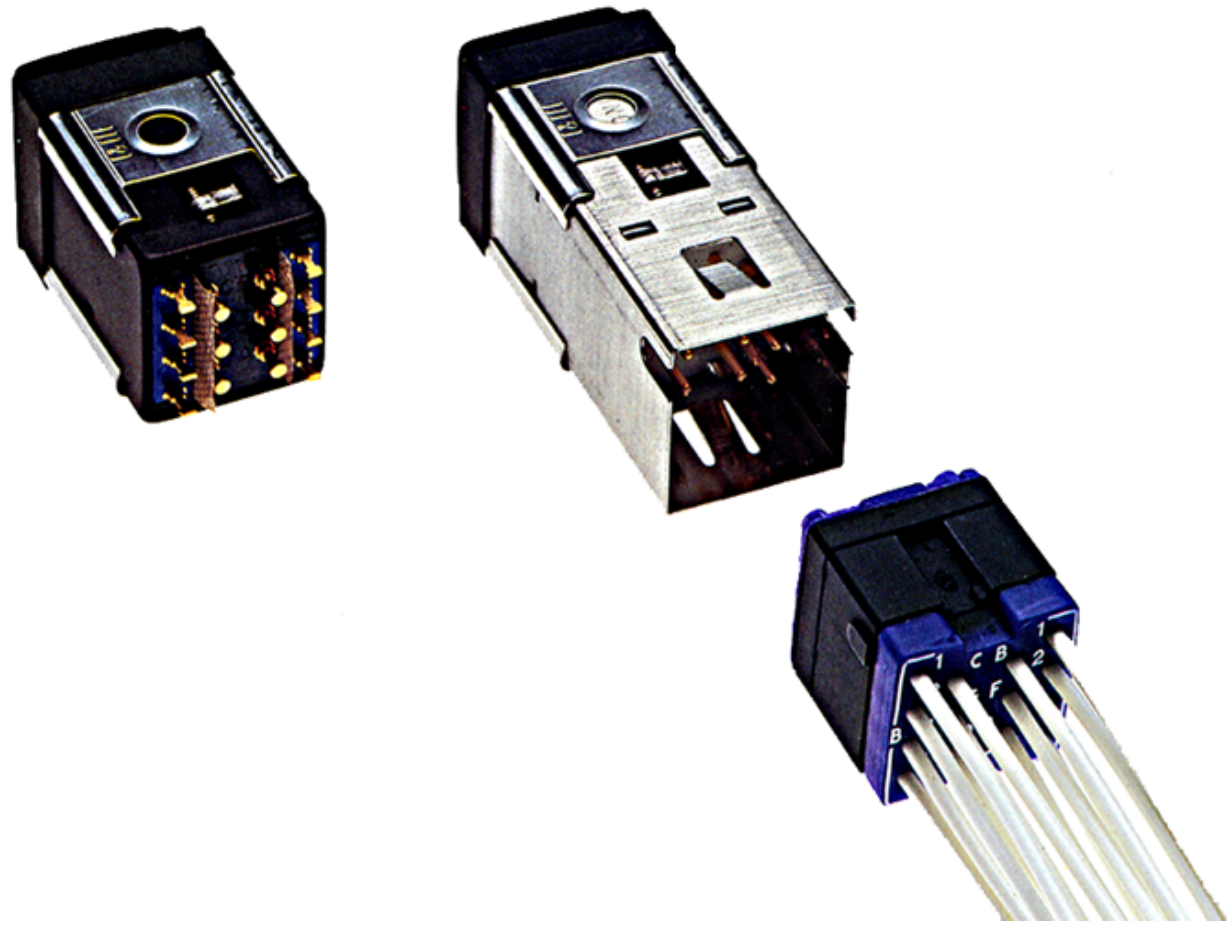
# VIVISUN 95™

MIL-S-22885/108

# SERIES VIVISUN 95™

## Now shorter and lighter in two convenient packages- Standard solder terminations and the new exclusive QUIK-CONNECT™ solderless terminations

Designed and qualified to MIL-S-22885/108

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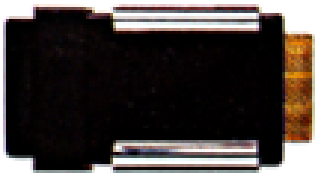

Designed and qualified to
MIL-S-22885/108

As the technical leader in sunlight readable switches and annunciators, Aerospace Optics set out to develop an advanced illuminated pushbutton switch to meet the complex and ever-demanding requirements of cockpit systems. The new SERIES 95 product line puts the superior optics you have come to expect from the VIVISUN 20/20 into a smaller, lighter package for your convenience.

**Series 95 means low weight**

Whether the application be for military or civilian avionics, weight reduction is a major concern with systems designers. A heavy or cumbersome package can make any black box undesirable on weight-sensitive aircraft. With that in mind, the SERIES 95 has a maximum weight of only 0.63 ounces (18 grams), about half that of conventional 4-lamp pushbutton switches. That savings can add up to lower assembly weights as well as better vehicle performance.

Aerospace Optics gives the design engineer what he needs most-unmatched performance in a lightweight package.

**Series 95 means small size**

Panel space is at a premium in modern cockpits and will be even more so in the future. Crew stations are continuously reaching new levels of complexity, making it necessary to achieve maximum utilization of a display area. The VIVISUN 20/20 recognized this with its new SERIES 95. Requiring just a 0.75 inch square area, you won't find a smaller 2-pole switch with the same features anywhere. The miniature size can place more capacity in less space, an essential item in today's crowded cockpits.

Not surprisingly, the area behind a panel is being scrutinized by designers also. Standards for mounting depth are being tightened in order to make room for other equipment or reduce space. With the increased activity toward low depth and flat panel display technologies, switching components are also finding themselves constrained by more stringent requirements. Using only 1.115 - inches behind the panel face (not including terminals), VIVISUN 20/20 met the challenge to provide compact dimensions to pushbutton switches.

Don't get the idea, however, that the small size means limited capability. Aerospace Optics made sure that the high standards and many features of the other popular VIVISUN 20/20 products are exceeded by the SERIES 95.

**Sunlight readable and non-ghosting**

In today's sophisticated cockpits, the demands on pilot time are extensive and the possibility of misinterpreted annunciators cannot be tolerated. The importance of sunlight readable lighted switches and indicators has reached a new level of priority. Through a unique lighting system, VIVISUN 20/20 displays satisfy this requirement, preventing the possibility of washout in direct sunlight conditions.

All Aerospace Optics VIVISUN 20/20 displays meet the MIL-S-22885D requirements for sunlight readability. All colors have an on to background luminance contrast ratio of 0.6 or greater (0.4 or greater for blue) at all glare producing angles up to and including 15.°

Chrominance contrast, or color difference, also plays an important role in reading an illuminated display in a high ambient light condition. Colors in basic order of preference for chrominance contrast are as follows: red, green, yellow, blue, and white.

When luminance contrast and chrominance contrast factors are combined, an Index of Discrimination (ID) is yielded. For a display to be considered sunlight readable the ID should be greater than 1. Aerospace Optics VIVISUN 20/20 displays meet this requirement in all colors and at all glare producing angles up to and including 30°.

Another area of tremendous pilot concern is the possibility of "Ghost Legends" from unenergized displays. Direct sunlight can cause a false image to be reflected from an unlighted indicator, thus causing possible confusion. Aerospace Optics, through dedicated research, has created a method which totally eliminates ghosting and produces a total dead face when not illuminated as per MIL-STD-411.

This advanced technology, incorporated into all VIVISUN 20/20 series pushbutton switches and indicators, has created the standard for cockpit lighting. Sunlight readable requirements have been achieved so that the message is not only readable when energized in a


sunlight condition (10,000 foot-candles ambient), but is totally imperceptible when not illuminated, thus eliminating the possibility of "Ghost Legends".

**10 color selections**


* NVIS yellow * NVIS green B
* Visible white with blue white night legend lighting
* Visible white with red night legend lighting
* Visible white with NVIS green B night legend lighting

The same technology that made us first in sunlight readable red, yellow, green, white and blue has now allowed us to provide NVIS yellow and NVIS green B for night vision goggle use. Besides these seven sunlight readable colors, three additional versions are available with visible white legends and color night legend lighting. Visible white provides a constant display at all times until supplemented by its illuminated color of blue white, red or NVIS green B. Only VIVISUN 20/20 delivers such a selection of advisory colors for safety and better pilot/system interface.

**Low touch temperature**

One of the traditional ways to solve the sunlight readability problem in illuminated switches was to use more current and higher mean spherical candle power lamps to produce higher intensity readings on the legends.

Unfortunately, this method not only failed to solve the problem of sunlight readability, but also created the problem of very high surface touch temperatures on the face of the switch. Heat from the indicator lamps could make it extremely uncomfortable (if not actually painful) to actuate.

Aerospace Optics has designed its VIVISUN 20/20 switches to take advantage of low power



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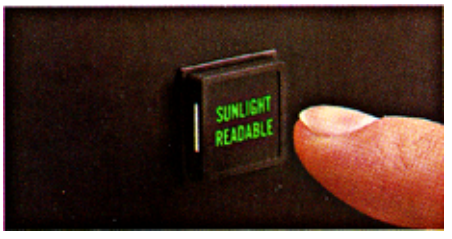
T-1 lamps, thereby avoiding the high power consumption and high levels of radiated heat that are standard for other lighted switches used in the same capacity. Our unequaled optics allow high contrast switch legends under sunlight with much less power, creating a much lower touch temperature.

When compared with an ordinary MIL-S-22885D switch utilizing T-1 3/4 lamps under identical conditions, the VIVISUN 20/20 produces a surface touch temperature up to 35% cooler.




To eliminate surface touch temperature problems and any potential heat difficulties, the 5 volt, .060 amp, T-1 lamps should be used. In cases where other types of lamps are used, a maximum power of 1.35 watts should not be exceeded for each switch used. For applications using multiple switches mounted in close proximity to other heat generating sources, the design must be such that the switch face cap temperatures do not exceed 85°C.

**Uniform trimmable with no hot spots**

Besides being readable in direct sunlight, cockpit lighting displays must also be legible under night flying conditions when lamp power is trimmed. This demands an exacting uniformity over a wide range of lighting situations. In response to these needs, Aerospace Optics designed the VIVISUN 20/20 SERIES 95 using low power T-1 lamps and an unmatched imaging process.

All illuminated colors dim uniformly, even at the low voltages used for night flying. A common problem in older lighting systems is "hot spots" that develop when power is trimmed, so that part of the message is too brightly illuminated, while other segments are barely discernible. This creates a definite hazard for air crews since an important message may be missed. The unique optics of the VIVISUN 20/20 provides greater uniformity and complete visibility at all voltage levels.

Color differentiation at low voltage levels has also been a design problem, especially where white and yellow are used, since the two colors tend to appear similar at low voltage. The VIVISUN 20/20 solves this problem so that, even at night, there is no confusion as to the color of the message.

For superior performance in both low level readability and sunlight readability, the VIVISUN 20/20 is the logical solution.

**Night Vision Goggle (NVG) compatible**

Military interservice use of Night Vision Goggles (NVG) has increased significantly over the last few years. These goggles enhance and multiply the effects of light at night, allowing the crew to see ground targets with amazing clarity. VIVISUN 20/20 NVG switches combine uniform low level lighting capability for use with the NVIS (Night Vision Imaging System) and PVS-5A (Gen. II) night vision goggles, along with the sunlight readability characteristics of all VIVISUN 20/20 displays.

Now that the tactical usefulness of night vision goggles has been recognized, several associated problems have become evident with providing cockpit light compatible with such image intensifiers.

With conventional cockpit lighting, night vision goggles suffered a loss in sensitivity when the displays were driven at a bright enough level to be readable with the unaided eye. The only alternative was to dim all lighting in the cockpit until the display could be comfortably viewed through the goggles. Unfortunately, this made the displays non-legible to any crew member not wearing goggles. Even this alternative did not ensure against an unnoticed loss of sensitivity in the goggles' sophisticated gain circuitry.

By use of selective filtering, VIVISUN 20/20 NVG displays provide lighting easily readable to the naked eye while not interfering with the viewing of outside scenes through either the NVIS or PVS-5A goggles. VIVISUN 20/20 displays eliminate the veiling glare and halo

effects which are prevalent with conventional cockpit lighting. Elimination of these phenomena also removes windscreen reflections for cockpit crewmembers as well as suppressing a possible target signature that could be detected by hostile personnel having access to image intensifiers.

**Easy installation/easy maintenance**

Each SERIES 95 unit is supplied with a mounting sleeve for simple, effortless installation. No loose screws or cumbersome tools behind the panel to worry about. All retaining hardware for the SERIES 95 is provided internally, allowing you easy mounting from the front of the instrument panel.

Lamps are replaced from the front of the unit -without tools- by simply extracting the front pushbutton cap. Whether for retrofit or new installations, VIVISUN 20/20 minimizes downtime in your product.

**Fully independent lamping**

The new SERIES 95 offers advantages similar switches can't match- like separate and fully addressable lamp circuits. Up to four legends per display can be individually lighted and individually controlled. All legend arrangements are available with momentary or alternate switch actions in either SPDT-DB (Double Break) or DPDT-DB contact configurations. Combine this with the SERIES 95 vertical or horizontal split ground options and you have the most versatile pushbutton lighted switch in its class.



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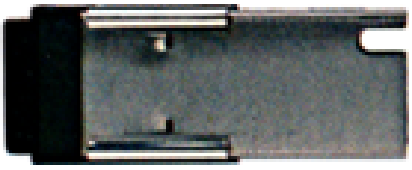

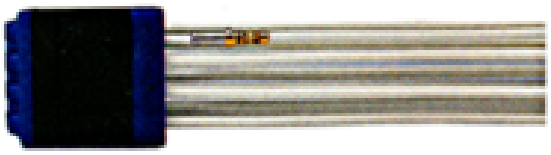

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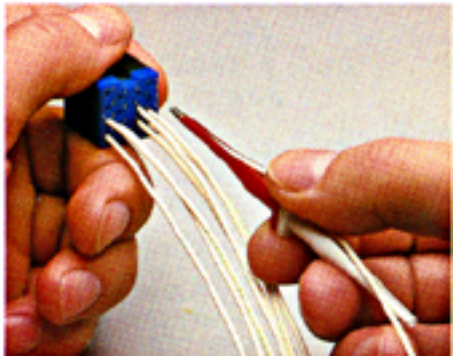
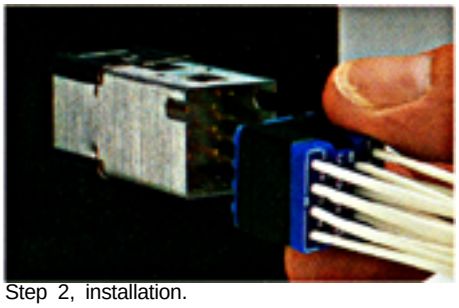
**Series 95 exclusive Solderless QUIK-CONNECT™ module**



Step 1, pre-wiring.



Step 2, installation.

Since avionics hardware is seldom installed at the same time as its associated wiring harness, system engineers are often faced with the inability to check correct component wiring until after the final connection is completed. In addition, when components are replaced or serviced, it is often necessary to entail a tedious soldering process. This leads to downtime and the possibility of incorrect wiring.

Only the SERIES 95 lighted pushbutton from Aerospace Optics offers a solution to these problems with a Common Termination System (CTS) designed in accordance with MIL-STD-1549.

Our exclusive QUIK-CONNECT™ module makes wiring quick, easy and environmentally sealed. All electrical strands are snapped into the module with standard MIL-C-39029/22 contact sockets using a M81969/14-10 insertion/removal tool. Modules may be pre-wired to the wire harnesses since the module is physically separate from the switch itself. Individual wires and contacts may be checked for correct continuity, thus the likelihood of accidental miswiring when connected to the VIVISUN 20/20 is all but eliminated.

Installation is also a snap. Mating the QUIK-CONNECT™ module with the SERIES 95 switch requires no tools and takes only about 5 seconds. The keyed module prevents orientation errors and is simply pressed into place until locked. To remove, insert the Aerospace Optics extraction tool (P/N 18-234) into the slots at top and bottom of the module. Push to release the snap tabs in the switch housing and gently pull the connector free.

No soldering. Easy, bench-testable wiring. Quick connect/disconnect times. Only the SERIES 95 offers this ultimate in convenience and time saving wire termination system. Aerospace Optics' commitment to advanced connector design has made possible the first ever use of CTS technology for illuminated pushbuttons and annunciators.

**Spade, turret & wire wrap/ PCB solder terminals available**

SERIES 95 switches are also available with spade, turret and wire wrap/PCB solder terminals to provide the user with a wide selection of connection possibilities.

**Horizontal and vertical split ground**

The standard VIVISUN 20/20 provides for a lamp circuit which has one input to each of the four lamps and a single ground common to all four lamps. The horizontal split ground option provides for a lamp circuit which has one input to each of the four lamps and two separate grounds, one connecting the upper two lamps and one connecting the lower two lamps. The vertical split ground option provides for a lamp circuit which has one input to each of the four lamps and two separate grounds, one connecting the two left positioned lamps and one connecting the two right positioned lamps.

**Dripproof/watertight/splashproof feature**

The optional sealed enclosure design meets the dripproof, watertight and splashproof requirements of MIL-S-22885D (paragraphs 4.8.20.1-3) and MIL-STD-108. The seal effectively prevents the leakage of water, sand and dust through the instrument panel.

Each sealed unit is supplied with a mounting sleeve, sealed mounting spacer, sealed mounting flange and sealed cap. The seal is made from high grade durable silicone rubber per ZZ-R-765 with a black matte finish.

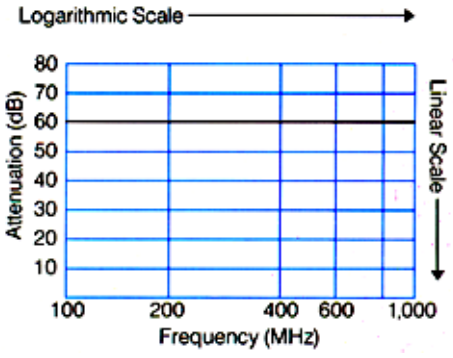
The pushbutton cap seal still provides easy access to the front lamps. To replace lamps simply slip fingernails under the outer edge of the seal and pull forward. To reseal, press cap back into switch and apply finger pressure to the corners and edges of the seal.

**High impact shock**

For operations where high impact shock may be encountered (collision impacts, nearby explosions, field conditions, etc.), the SERIES 95 sealed momentary switch meets the strict requirements of MIL-S-22885D (Paragraph 3.21.2). This unit is designed to withstand the rugged impact sometimes encountered in military usage and to be mechanically and electrically operable at all times under these conditions.

**EMI shielding**

SERIES 95 switches are available with an EMI option which provides for an electromagnetic interference shielding effectiveness in excess of 60 decibels of attenuation in the frequency range of 100 to 1000 MHz per MIL-S-22885D. Testing consists of plane wave measurements at 100, 200, 400, 600, 800 and 1,000 MHz.



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### Measurement and certification of sunlight readability

All Aerospace Optics Inc. VIVISUN 20/20 displays are readable in direct sunlight. Certification of sunlight readability is performed by photometrically determining the contrast ratios for each legend by using the specular reflectance test method outlined in MIL-S-22885D, paragraph 4.8.35.

The test method uses a light source of 3000°K to 5000°K which is placed at a 15 degree angle of incidence to a white barium sulfate standard. A photometer is placed at a -15 degree angle of reflection to the barium sulfate standard. The light source is used to illuminate the barium sulfate so as to produce 10,000 foot-candles as measured by the photometer. The barium sulfate standard is then replaced by the viewing surface of the display to be tested, keeping the same incident and reflective angles for both the light source and the photometer (Fig. A).

Using this test configuration the luminance of the legend, both illuminated and non-illuminated, plus that of the adjacent background areas are measured. Three luminance readings per legend character are taken. These measurements are then used to calculate the contrast ratios for each character. The contrast ratios are calculated from the following equations:

$$\text{ON/BACKGROUND contrast } C_L = \frac{B_2 - B_1}{B_1}$$

$$\text{OFF/BACKGROUND contrast } C_{UL} = \frac{B_3 - B_1}{B_1}$$

where:
$B_1$ = Average background luminance
$B_2$ = Average character luminance, lighted
$B_3$ = Average character luminance, unlighted

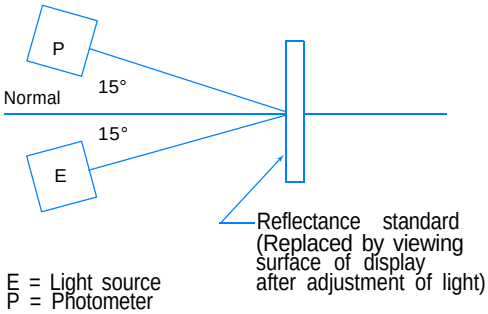


Fig. A

These luminance contrast ratios are averaged and must meet a minimum luminance ON/BACKGROUND contrast ratio $C_L$ of 0.6 (0.4 for blue). The average OFF/BACKGROUND contrast ratio $C_{UL}$ of each unlighted legend character must have an absolute value less than 0.1.

The color contrast is also measured in certifying sunlight readability. When the effects of luminance contrast and chrominance contrast are combined, an Index of Discrimination (ID) may be calculated. For a legend to be considered sunlight readable, the minimum ID should be 1.0 as measured using the same specular reflectance test set-up (Fig. A) detailed for calculation of the luminance contrast ratios $C_L$ and $C_{UL}$. The Index of Discrimination is calculated from the following equations:

$$C = \frac{\text{Log}_{10}\left(\frac{L_1 + L_2}{L_b}\right)}{0.15}$$

$$C_C = \frac{\sqrt{(u_1 - u_b)^2 + (v_1 - v_b)^2}}{0.027}$$

$$ID = \sqrt{C^2 + C_C{}^2}$$

where:
ID = Index of Discrimination
C = Luminance contrast
$C_C$ = Chrominance contrast
$L_1$ = Average character luminance of illuminated legend
$L_2$ = Average reflected character luminance of non-illuminated legend
$L_b$ = Average reflected background luminance
$u_1, v_1$ = Average 1960 UCS color coordinates of the reflected and emitted light from the illuminated legend
$u_b, v_b$ = Average 1960 UCS color coordinates of the reflected background light

All Aerospace Optics VIVISUN 20/20 sunlight readable displays are certified to meet the ID requirements at measured incidence angles up to and including 30 degrees.

### Measurement and certification of NVIS compatibility

Compliance of Aerospace Optics VIVISUN 20/20 displays to the requirements of MIL-L-85762A, "Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible," is certified by spectroradiometry. NVIS Radiance units (NR) are calculated using radiometric data for both NVIS green B and NVIS yellow displays. The test procedure for measuring the spectral radiance of the legend for either color is in accordance with MIL-L-85762A, paragraph 4.8.14, and is performed as follows:

A display to be certified as NVIS compatible is first set to an average illuminated character intensity of 15 foot-lamberts. The display is then analyzed between the wavelengths of 450 nm and 930 nm using a computer controlled scanning spectroradiometer. A spectral radiance curve is generated by the spectroradiometer, with units of the curve being in watts/($cm^2$-nm-sr).

For a NVIS yellow display, this curve is applied against the standard response curve for the Class A NVIS goggles covered by MIL-L-85762A. In doing this a quantitative value is derived which is in direct units of watts/($cm^2$-sr), but are henceforth termed NVIS Radiance units (NR). The formula used for this mathematical procedure is the following:

$$NR = \int_{450}^{930} G_A(\lambda)\, N(\lambda)\, d\lambda$$

where:
NR = NVIS Radiance units
$G_A$ = relative NVIS response (dimensionless)
N = absolute spectral radiance of lighting component (W/($cm^2$-nm-sr))
$d\lambda$ = wavelength Increment (5 nm)

For NVIS yellow display to be considered NVIS compatible, the value from the above equation must be between $0.5 \times 10^{-7}$ NR and $1.5 \times 10^{-7}$ NR

For NVIS green B, the NR units are calculated at 0.1 foot-lamberts. In order to achieve this, the spectroradiometric scan at 15.0 foot-lamberts must have each term multiplied through by a scaling factor in order to make the relative luminance level 0.1 foot-lamberts. The formula used for calculating the NR value of NVIS green B displays is:

$$NR = \int_{450}^{930} SG_A(\lambda)\, N(\lambda)\, d\lambda$$

$$S = L_r / L_m$$

where:
$L_r$ = required luminance level for NR measurement (0.1 foot-lamberts)
$L_m$ = measured luminance (15 foot-lamberts)

All other values in this equation are the same as represented in the formula for NVIS yellow NR measurement. Using this method the maximum NR units must be calculated to be less than $1.7 \times 10^{-10}$ for the NVIS green B display to be considered NVIS compatible.

VIVISUN 20/20 NVIS compatible displays are also certified for chromaticity compliance to MIL-L-85762A spectroradiometrically.

The NVIS green B color is within a circle where $u'_1 = .131$, $v'1 = .623$ is the center and the radius is .057, this when the legend luminance is set at 0.1 foot-lamberts. The NVIS yellow color is within a circle having $u'_1 = .274$, $v'_1 = .622$ as the center and a radius of .083,


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*Aerospace Optics spectroradiometer used in measuring and certifying NVIS compatibility.*

the legend luminance being set at 15.0 foot-lamberts. The test procedure for measuring the NVIS green B or NVIS yellow luminance and color shall be in accordance with MIL-L-85762A, paragraph 4.8.12 and 4.8.13 respectively.

$$(u'-u'_1)^2 + (v'-v'_1)^2 \leq (r)^2$$

where:

u', v' = 1976 UCS chromaticity coordinates of the test article.

$u'_1$, $v'_1$ = 1976 UCS chromaticity coordinates of the center point of the colors specified above.

r = Radius of the allowable circular area on the 1976 UCS chromaticity diagram for the specified color.

Aerospace Optics Inc. has in-house facilities qualified to make the above measurements and all others necessary to certify compliance to MIL-L-85762A.

### Type S versus Type N displays

MIL-S-22885D describes several display types in paragraph 1.2.6. Aerospace Optics provides the VIVISUN 20/20 SERIES 95 pushbutton switches in a choice of two of these display types. The Type S display is sunlight readable where legends are not visible until illuminated. When illuminated, the legends light up in their specified color and are readable in direct sunlight. The background is always black.

The second display choice is the Type N display which has an opaque black background with always visible white legends. These legends are reflective white and are readable in any ambient light condition except darkened conditions. In darkened conditions the white legends can be illuminated at a level of 0.5 to 3.0 foot-lamberts maximum in any one of three specific colors. The three available colors are red or blue white per MIL-P-7788E or NVIS green B per MIL-L-85762A.

### Touch temperature

The use of illuminated pushbutton switches in early aircraft cockpit designs revealed the unique problem of sunlight washout (the inability to discern a legend on versus a legend off condition when the display is exposed to direct sunlight). Attempts made to solve this problem included the use of high intensity lamps placed close behind the display's front legend surface in order to maximize the output brightness. These high power, high heat generating lamps caused a situation wherein the touch temperature of the front legend surface became so hot as to be untouchable without extreme discomfort or actual pain. In some cases the intense heat generated by these lamps caused heat damage including discoloration, blistering, bubbling and delamination of the pushbutton legend cap.

These extremely high touch temperatures, as measured at room ambient, ranged from 85°C for some 5 volt lamps to 106°C for 28 volt lamps when four lamps were energized. MIL-STD-1472, "Human Engineering Design Criteria," sets forth guidelines for thermal hazards in equipment usage. These guidelines require that the surface temperatures of any equipment in normal operation be 60°C maximum or be appropriately guarded from inadvertent contact. If the equipment is to be handled, the maximum temperature is to be 49°C maximum. Surface temperatures induced by climatic environment are exempt from these guidelines. Since pushbutton switches require only intermittent physical contact for operation, their surface touch temperatures should be held to 60°C maximum.

To solve the problem of touch temperature, Aerospace Optics designed the VIVISUN 20/20 pushbutton switches to take advantage of low power T-1 lamps and provide optics to maintain high display brightnesses so as to achieve sunlight readability. The result is a low power, low heat and low touch temperature pushbutton switch with all the advantages of a sunlight readable display without the undesirable side effects of extremely high surface touch temperatures. To fully take advantage of the low power lamp design, the lamp power dissipation should be limited to 1.35 watts maximum. This allows the continual use of four 5 volt, .060 amp T-1 lamps without producing high surface touch temperatures. For equivalent surface touch temperatures, the 5 volt, .115 amp T-1 lamps should be limited to a maximum of two lamps producing 1.15 watts. Also for equivalent surface touch temperatures, the 28 volt, .024 amp T-1 lamps should be limited to a maximum of two lamps on, producing 1.35 watts.

Individual switches mounted by their normal means to a 1/8" aluminum backup plate standing in free air at room temperature produce the following average front surface touch temperatures:

| Lamp Type | P/N | Voltage | Current | Average Surface Temperature (°C) 2 Lamps | 4 Lamps |
|---|---|---|---|---|---|
| 1 | 17-043 | 5 | .060 | 43°C | 49°C |
| 2 | 03-014 | 5 | .115 | 49°C | 65°C |
| 6 | 14-104 | 28 | .024 | 52°C | 74°C |

Where surface temperatures are induced by climatic environments, the total operating front surface temperature should be limited to 85°C maximum.

### High impact shock testing

Military equipment is sometimes expected to withstand the shock impact of underwater explosions, collision impacts, near-miss gunfire, blasts caused by air explosions, and field conditions. In order to test hardware which may be subject to use, MIL-S-22885D specifies testing in accordance with method 207 of MIL-STD-202. Although exact simulation of severe shock conditions in the field is difficult to reproduce, parts that successfully complete this test have been found to possess the necessary ruggedness to resist failure.

The test apparatus used in method 207 consists of two 400-pound hammers which contact a shock pad located on an anvil plate. The shock motion is transmitted by the anvil plate to the pushbutton switches attached on a mounting fixture. One hammer renders a blow by a vertical drop. The other hammer applies a force in a horizontal direction. By rotation of the anvil plate and separately employing both hammers of the apparatus, shock may be applied through the three principal perpendicular axes of the switch being tested.

A total of nine blows, three through each of the three main axes are delivered to the anvil plate supporting the test switches. Each sequence of three blows occurs with the hammer dropping from heights of 1 foot, 3 feet, and 5 feet. The direction of each sequence of three blows is first to the back, secondly to the top and lastly to the side.

During the shock testing, switch contact stability is continually monitored in accordance with method 310, test condition E of MIL-STD-202 (Contact-Chatter Monitoring). This test is conducted to detect contact-chatter in electrical components where it is required that contacts do not open or close in excess of 20 milliseconds. Also, no part of the switch may become displaced from its normal (ready to operate) position during shock testing. At the conclusion of the test, the switch must be electrically and mechanically operable.



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## SPECIFICATIONS

### MECHANICAL FEATURES:

**TYPE I CONFIGURATION:**

The Type I pushbutton switch configuration provides low weight, minimum length and a variety of solder terminations.

**Packaging Dimensions:** The Type I construction, physical dimensions and configuration conform to Figure 1.

**Lowest Weight:** 18 grams (.63 ounces) maximum including mounting sleeve and mounting spacer.

**Minimum Length:** Overall length is 1.310" less terminals. The behind panel depth is 1.093" maximum excluding terminals. See Figure 1 for length of terminals.

**Enclosure Design:** Unsealed.

**Housing Material and Finish:** Aluminum, black anodized.

**Solder Terminations:** The Type I configuration is available in three solder terminal styles: turret terminals, spade terminals or wire wrap/pcb terminals.

**TYPE III CONFIGURATION:**

The Type III pushbutton switch configuration provides an easy to install QUIK-CONNECT™ connector plug designed as a solderless common termination system (CTS).

**Packaging Dimensions:** The Type III construction, physical dimensions and configuration conforms to Figure 2.

**Low Unit Weight:** 26 grams (0.92 ounces) maximum including mounting sleeve and spacer, less connector plug.

**Connector Module Plug Weight:** 6 grams (0.21 ounces) maximum.

**Length:** Overall length is 2.002" including connector. The behind panel depth is 1.785" and is shortest available for any switch having a common termination system.

**Enclosure Design:** Unsealed.

**Housing Material and Finish:** Stainless steel.

**Wiring the QUIK-CONNECT™ Modular Plug:** The connector is wired like a common termination system but remains a removable plug on-plug off connector. See Figure 2.

**Solderless Termination:** MIL-C-39029/22-192 sockets are crimped onto 20, 22 or 24 gauge wire without soldering.

**Loading Wires:** Wires with the MIL-C-39029/22-192 sockets crimped on are inserted and extracted from the QUIK-CONNECT™ module by use of an M81969/14-10 tool.

**Mating the QUIK-CONNECT™ Module:** No tool is needed to plug the connector into the switch housing but an extraction tool, Aerospace Optics P/N 18-234, is required to unplug the connector.

**Type III Switch Housing Assembly:** The QUIK-CONNECT™ modular plug is not supplied with the Type III housing. It is ordered separately as Aerospace Optics P/N 18-200 (Includes Aerospace Optics P/N 18-215 sealing plugs).

**TYPE I AND TYPE III CONFIGURATIONS:**

The Type I and Type III pushbutton switch configurations offer several mechanical features common to both types.

**Mechanical Life:** 100,000 Cycles. Tested for 10,000 cycles at -55°C, 20,000 cycles at +85°C and 70,000 cycles at +23°C.

**Pushbutton Action:** Momentary, alternate or indicator.

**Operating Characteristics:**
Actuation travel: .I50" ± .031".
Actuation force: 2 to 5 pounds.

**Strength of Actuator:** 25 pounds static load.

**Pushbutton Cap Extraction Force:** 2 to 5 pounds.

**Keying:** Pushbutton cap is designed to prevent incorrect insertion. See Figure 3.

**Pushbutton Cap Captivation:** To prevent accidental interchange, the pushbutton caps are held captive to the switch housing by means of a metallic retainer which is permanently mounted in the switch housing. See Figure 3.

**Relamping:** Lamps are replaceable from the front of the switch housing without tools. Extraction slots are provided on the sides of the pushbutton cap so the cap can be pulled fully out of the switch housing. The cap is allowed to drop 90° where it is held by the retaining element. The lamps can then be easily removed and replaced. See Figure 3.

**Removal of Pushbutton Cap:** Caps may be changed, if need be, by popping the cap pins out of the retaining element rails and replacing with another cap.

**Panel Mounting Spacer:** A panel mounting spacer is supplied with each unit so as to place the switch mounting flange flush with a 0.235" thick edge lighted panel. For other switch applications the spacer is discarded.

**Mounting Spacer Material and Finish:** Corrosion resistant steel, black oxide.

**Mounting Sleeve:** A reversible mounting sleeve is supplied with each unit so as to be usable with or without the panel mounting spacer.

**Mounting Sleeve Material:** Stainless steel.

**Mounting Plate Thickness:** The mounting sleeve allows the switch to be installed on mounting plates ranging from 0.032" to 0.187" thick.

**Mounting Cutout Dimensions:** See Figure 4.

**Front Mounting:** The switch is mounted from the front surface by means of a screwdriver only. All mounting hardware is integral to the switch.

**FIGURE 1**
TYPE I DIMENSIONS

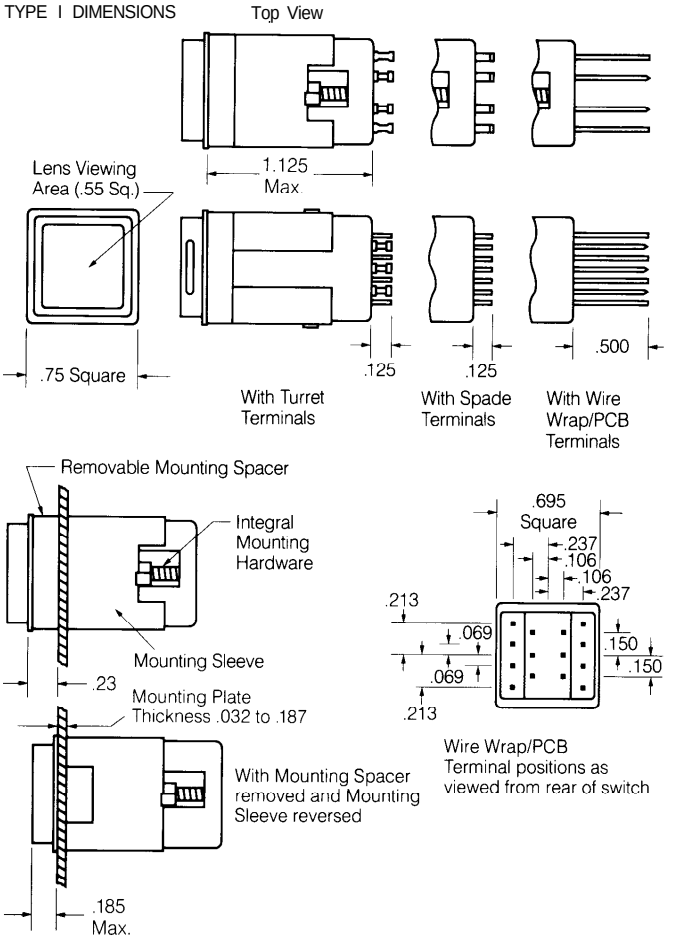


**FIGURE 2**
TYPE III DIMENSIONS

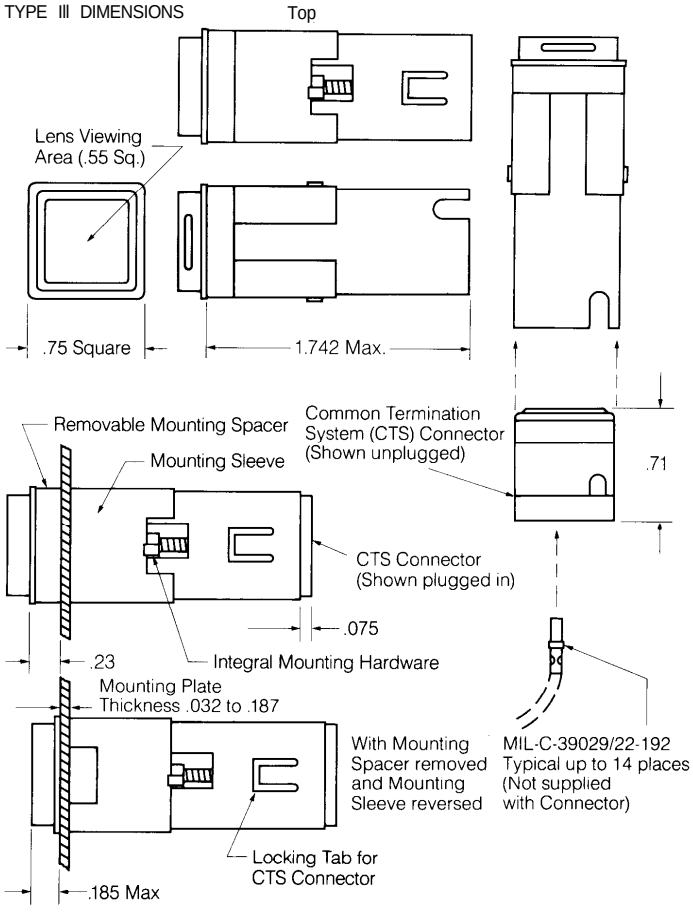




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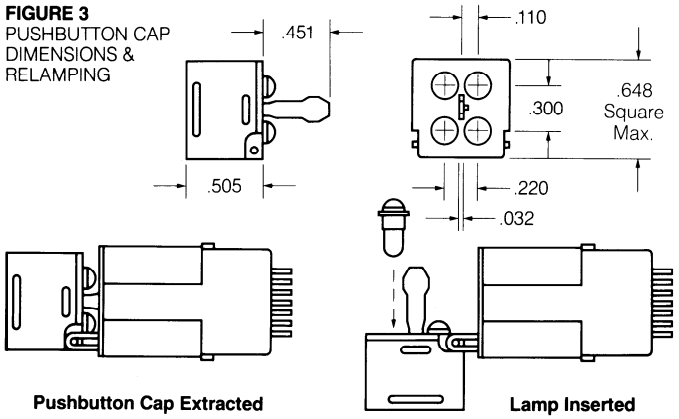
**FIGURE 3**
PUSHBUTTON CAP DIMENSIONS & RELAMPING




## ELECTRICAL FEATURES:

**Electrical Life:** 50,000 cycles minimum at rated loads in a +85°C ambient temperature.

**Switch Contacts:** The switch contacts are available in silver with gold flash or gold plate.

**Switch Contact Ratings:**

SILVER CONTACTS WITH GOLD FLASH

| | Load | Single Break | Double Break |
|---|---|---|---|
| **28** VDC @ sea level | Resistive | 7.5 amps | 5.0 amps |
| | Inductive | 4.0 amps | 2.0 amps |
| | Motor | 4.0 amps | - |
| | Lamp | 1.0 amps | - |
| **28** VDC @ 50,000 ft. | Resistive | 4.0 amps | 3.0 amps |
| | Inductive | 2.5 amps | 1.0 amps |
| 115 VAC, 60 HZ @ sea level | Resistive | 7.5 amps | - |
| | Inductive | 4.0 amps | - |

GOLD PLATED CONTACTS

| | Load | Single Break | Double Break |
|---|---|---|---|
| **28** VDC @ sea level | Resistive | 1.0 amps | - |
| | Inductive | 0.5 amps | - |
| **28** VDC @ 50,000 ft. | Resistive | 1.0 amps | - |
| | Inductive | 0.5 amps | - |

**Switch Type:** The basic snap action switches are qualified to MIL-S-8805/101 category I or category II.

**Switch Capacity:** Single pole double throw or double pole double throw only.

**Switch Contact Schematic:** The switch contact arrangements are either single break or double break. The double break allows two separate contact circuits or simply a single throw contact action. See Figure 5.

**Switch Contact Resistance:** 0.025 ohms maximum.

**Intermediate Current:** The intermediate current test per MIL-S-22885D paragraph 3.35 is applicable to the gold flash silver contacts. 50,000 cycles minimum, 12,500 cycles at -55°C, 25,000 cycles at +23°C and 12,500 cycles at +85°C.

**Low Level Life:** The low level life test per MIL-S-22885D paragraph 3.36 is applicable to the gold plated contacts. 50,000 cycles with contacts loaded at 30 millivolts maximum or peak AC at 10 milliamperes maximum. 12,500 cycles at -55°C, 12,500 cycles at +23°C and 25,000 cycles at +85°C.

**Dielectric Withstanding Voltage:**
At sea level: 1000 volts rms minimum, 60 HZ.
At 50,000 ft.: 400 volts rms minimum, 60 HZ.

**Lamp Circuit Schematic:** The lamp circuit is available with a common ground, horizontal split ground or vertical split ground. See Figure 6.

**Terminals:** Both the switch circuit and the lamp circuit terminals are gold plated brass.

**Switch and Terminal Identification:** The switch poles are denoted as position A and B. Switch terminals are marked 1, 2, 3 and 4. The lamp terminals are marked A, B, C, D, F and G. See Figure 7 for exact terminal identification.

**Low Power Lamps:** Four low power T-1 size flange based lamps are supplied with each pushbutton switch.

Three lamp types are available:

| Type | Voltage | Current |
|---|---|---|
| 1 | **5** volts | 0.060 amps |
| **2** | **5** volts | 0.115amps |
| **6** | **28** volts | 0.024 amps |

**Low Touch Temperature:** Heat dissipation properties designed into the pushbutton caps combined with the use of low power lamps results in the lowest touch temperature available from any pushbutton switch with similar features. The 5 volt, 0.060 amp lamp (P/N 17-043) produces a touch temperature of 43°C with two lamps on and 49°C with four lamps energized. The 5 volt, 0.115 amp lamp (P/N 03-014) produces a touch temperature of 49°C with two lamps on and 65°C with four lamps energized. The 28 volt, 0.024 amp lamp (P/N 14-104) produces a touch temperature of 52°C with two lamps on and 74°C with four lamps energized.

**EMI/RFI Shielding Option:** When specified, the shielding efficiency of the pushbutton switch is no less than 60db for frequencies from 100MHZ to I000MHZ.

**FIGURE 4**
MOUNTING PLATE CUTOUT DIMENSIONS TYPE I AND TYPE III SWITCHES

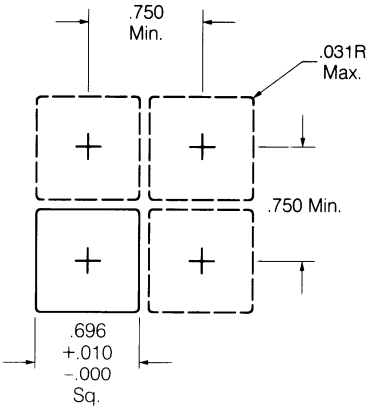



**FIGURE 5**
SWITCH CIRCUIT SCHEMATIC

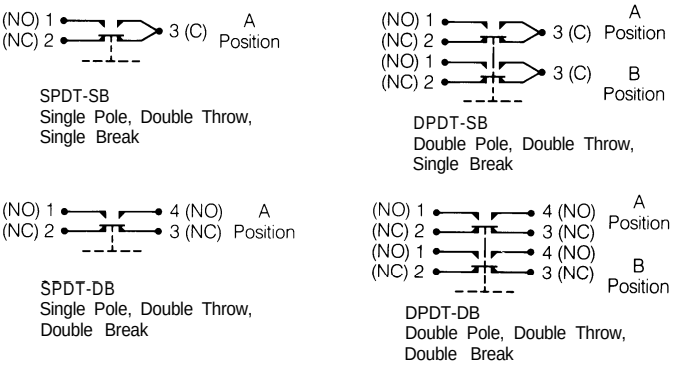
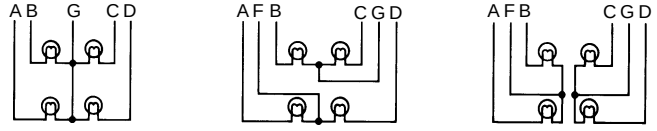
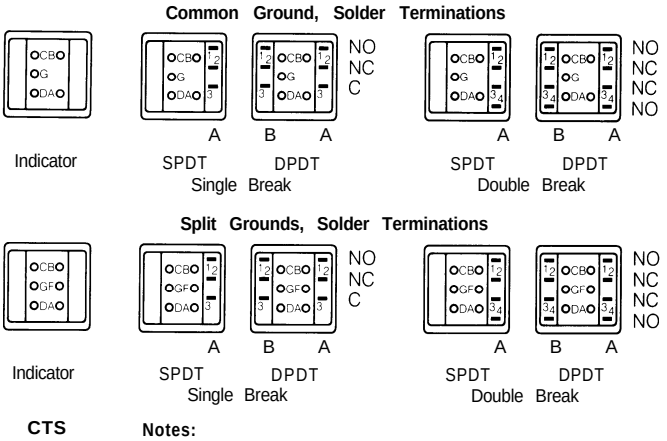



**FIGURE 6**
LAMP CIRCUIT SCHEMATIC

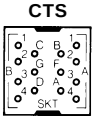



Lamp and terminal positions as viewed from the front of the display.

**FIGURE 7**
SWITCH POLES & LAMP TERMINAL ARRANGEMENTS AND IDENTIFICATION




**CTS**




**Notes:**

1. All Common Termination System (CTS) switches have identical switch pole and lamp terminal arrangement identification.
2. To make the various CTS combinations, an MS27488-20 or P/N 18-215 sealing plug is placed in the unused locations.
3. "SKT" identifies the socket side.
4. A and B identify each switch.
5. C, B, G, F, D and A Identify lamp circuit terminations.
6. 1, 2, 3 and 4 Identify the switch contact termination.



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## VISUAL FEATURES:

**NIGHT VISION GOGGLE COMPATIBLE LIGHTING:**

**Compatible Lighting:** VIVISUN 20/20 display legends which have Night Vision Goggle (NVG) compatible lighting do not cause any interference with night vision goggles when the legends are operated at a specific luminance level which is visible with the naked eye.

**Need for Compatible Lighting:** Night vision goggles are used by pilots to intensify the brightness of scenes illuminated by starlight to a level where they are clearly visible to the naked eye. Any non-compatible lighting source within the cockpit can interfere with the goggles operation. This interference causes a degradation in the goggles sensitivity and results in the goggles shutting down and no longer capable of starlight operations.

**Elimination of Interference:** The VIVISUN 20/20 NVG compatible lighting eliminates veiling glare and halo effects which Interfere with goggles operation. The compatible lighting also eliminates the emission of radiant energy which might be detectable as a cockpit target signature.

**NVIS Goggle Compatible:** The NVG compatible display lighting is designed specifically to be compatible with NVIS (Night Vision Imaging System) AN/AVS-6 goggles. These goggles use generation III image intensifying tubes and are highly sensitive in the radiant energy wavelength range from 600 nanometers to 930 nanometers and can be used in starlight operations. The goggle sensitivity is highly restricted below 600 nanometers. The VIVISUN 20/20 NVG compatible lighting restricts the display's radiant energy output to wavelengths less than 600 nanometers.

**PVS-5A Goggle Compatible:** The NVG compatible lighting is also compatible with PVS-5A goggles. These goggles use generation II and II & 1/2 image intensifying tubes and are sensitive from 350 nanometers to 930 nanometers. The sensitivity is much less than NVIS so use of these goggles are normally restricted to moonlight conditions. The VIVISUN 20/20 NVG compatible lighting can be reduced in intensity to a point where the radiant energy does not interfere with these goggles but the intensity remains high enough to be visible with the naked eye.

**Conformance to Specification:** The VIVISUN 20/20 NVG compatible lighting conforms to MIL-L-85762A "Lighting, Aircraft, Interior, Night Vision Imaging System (NVIS) Compatible" paragraph 3.10.8 and Table VIII, NVIS green B and NVIS yellow colors and paragraph 3.10.9 and Table IX for Caution and Advisory Lights (NVIS green B) and Warning Signals (NVIS yellow) for spectral radiance.

**NVIS Compatible Colors:** The NVG compatible lighting is available in two colors, NVIS green B and NVIS yellow. The NVIS green B is within an area bounded by a circle whose center is at $u'_1$=0.131, $v'_1$=0.623 with a radius r=0.057 and the spectral locus on the 1976 UCS diagram. The NVIS yellow is within an area bounded by a circle whose center is at $u'_1$=0.274, $v'_1$=O.622 with a radius r=0.083 and the spectral locus on the 1976 UCS diagram. See Figure 8.

**Luminance, Voltage and NVIS Radiance:** The NVIS green B color produces a NVIS radiance less than $1.7x10^{-10}$ NR units at 0.1 foot-lamberts of intensity (approximately 6 volts for 28 volt lamps and 1.1 volts for 5 volt lamps). The NVIS yellow produces a NVIS radiance between $0.5x10^{-7}$ and $1.5x10^{-7}$ NR units at 15.0 foot-lamberts of intensity (approximately 13.5 volts for 28 volt lamps and 2.3 volts for 5 volt lamps).

**Spectral Distribution:** The spectral radiance energy distribution for NVIS green B and NVIS yellow colors are shown in Figure 9.

**Relative NVIS Response:** The relative NVIS response as defined in MIL-L-85762A is shown in Figure 9.

**NVIS Radiance:** The NVIS radiance of the NVIS green B and the NVIS yellow colors at 15 foot-lamberts are shown in Figure 10. The integrals of the NVIS green B curve times 1/150 gives the NVIS green B radiance. The integral of the NVIS yellow curve times 1 gives the NVIS yellow radiance.

**SUNLIGHT READABLE LEGENDS:**

**Legend Readability:** The legends when energized at rated voltage are readable in direct sunlight (10,000 foot-candles) including any glare producing angle up to 15° to the normal of the display viewing surface. When the lamps are not energized the legends are not discernible and cannot be read in direct sunlight (10,000 foot-candles).

**Background Color:** The legend viewing area background is a diffuse, matte finish black to eliminate undesirable glare reflections and minimize direct sunlight reflections. This enhances the viewability of the legends in direct sunlight.

**Luminance Contrast:** The average luminance contrast ratio for any lighted legend to background is 0.6 minimum (0.4 minimum for blue) in direct sunlight (10,000 foot-candles) at all glare producing angles up to and including 15° to the normal of the display viewing surface.

**Test Method:** Measurement of the luminance contrast is achieved by using the specular reflectance test method per MIL-S-22885D, paragraph 4.8.35. Values of the luminance contrast ratios for each color at glare angles of 15° are shown in Figure 11.

**Color Contrast:** In addition to luminance contrast, color contrast is an important factor in sunlight readability. The most readable color is red then green, yellow, blue and white which has the least color contrast.

**Index of Discrimination:** To take into account color contrast as well as luminance contrast a value called the Index of Discrimination (ID) is determined. This value must exceed 1.0 for the display legends to be considered as sunlight readable. The value of the Index of Discrimination for each color at a glare angle of 15° are shown in Figure 11.

**Minimum Brightness and Typical Color Coordinates:**

| Color | Brightness in Foot-Lamberts | Chromaticity x | y |
|---|---|---|---|
| Red | 150 | .690 | .310 |
| Green | 200 | .360 | .605 |
| Yellow | 300 | .585 | .410 |
| Blue | 150 | .280 | .405 |
| White | 250 | .430 | .400 |
| NVIS green B | 200 | See Figure 8 | |
| NVIS yellow | 200 | See Figure 8 | |

x and y chromaticities are in 1931 CIE Diagram coordinates. For color limit boundaries see Figure 12.

**FIGURE 8**

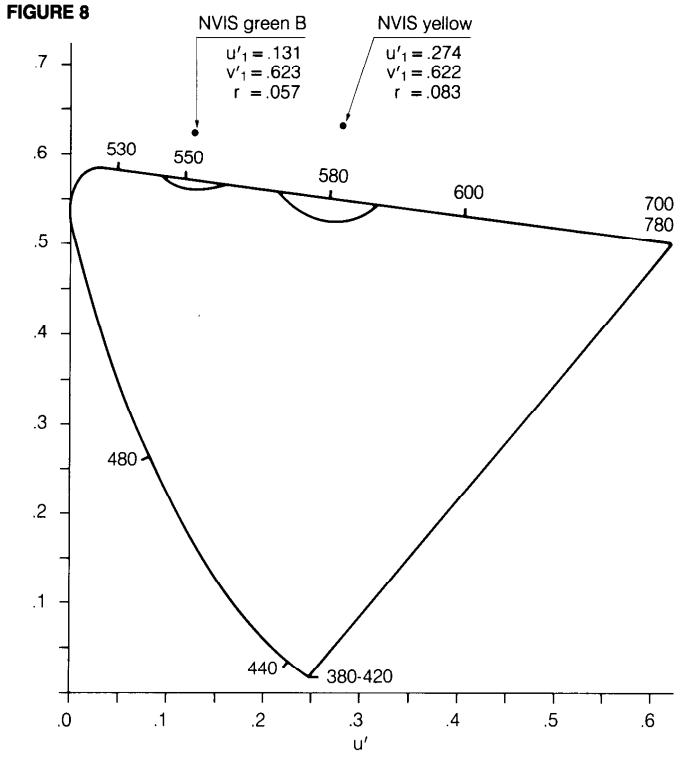



**FIGURE 9**

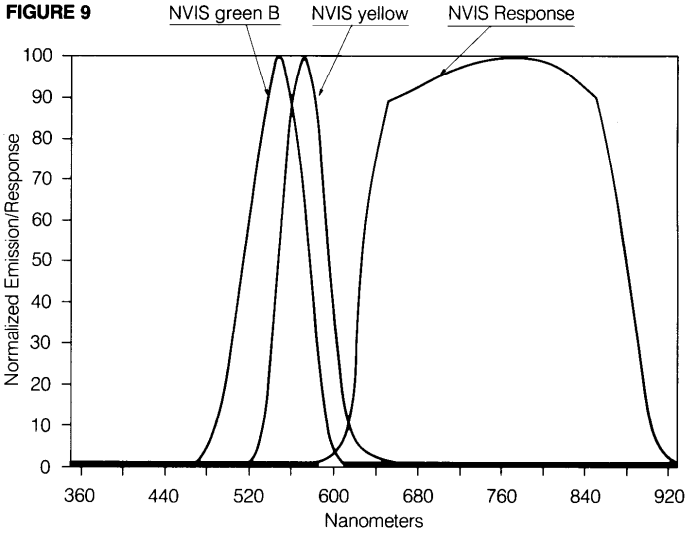
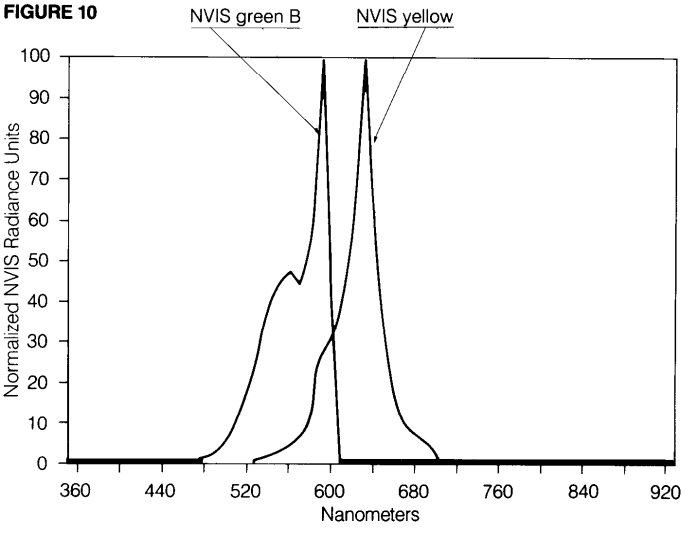



**FIGURE 10**



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**VISIBLE LEGEND DISPLAYS:**

**Visible Legend:** VIVISUN 20/20 visible legend displays are Type N per MIL-S-22885D, paragraph 1.2.6 and have visible legends with illuminating characters on an opaque background.

**Always Visible White:** The legends are reflective white so as to be visible in any light ambient condition except darkened conditions.

**Lumination Levels:** In darkened conditions the lamps can be energized to produce a legend lumination of 0.5 to 3.0 foot-lamberts.

**Color of Illumination:** The color of the illuminated visible white legends are either red or blue-white per MIL-P-7788E or NVIS green B per MIL-L-85762A.

**ADDITIONAL VISUAL FEATURES:**

**Low Level Uniformity:** The displays are uniformly dimmable and at low intensity levels maintain their brightness uniformity, having no hot spots.

**Viewing Angle:** 150° peripherally in direct sunlight and 30° in glare producing conditions.

**Lettering Style:** All sunlight readable legends are Globe Condensed caps and all visible white legends are Futura Medium Condensed. Exception: 0.072" characters are Alternate Gothic Condensed.

**Character Size:** Legends are available with character heights of 0.156," 0.125," 0.109" and 0.072".

## ENVIRONMENTAL CONDITIONS:

**Temperature:** Operating -55°C to +85°C.
Nonoperating -55°C to +95°C.

**Thermal Shock:** In accordance with MIL-STD-202, method 107, test condition A.

**Altitude:** Sea level to 50,000 ft.

**Shock:** In accordance with MIL-STD-202, method 213, test condition B, 75 G's.

**Vibration:** In accordance with MIL-STD-202, method 204, test condition B (l0-2,000 HZ).

**Moisture Resistance:** In accordance with MIL-STD-202, method 106 as modified by MIL-S-22885D.

**Fungus:** In accordance with MIL-STD-454, requirement 4.

**Salt Spray:** In accordance with MIL-STD-202, method 101, test condition A.

**Explosion:** In accordance with MIL-STD-202, method 109.

## OPTIONAL SEALING FEATURE:

**Configurations:** The Type I and Type III configurations can be supplied optionally as sealed pushbutton switches. The Type I switch with the sealed option is referred to as Type II and the Type III switch with the sealed option is referred to as Type IV.

**Packaging Dimensions:** The Type II and Type IV physical dimensions conform to Figure 13.

**Sealed Pushbutton Caps:** The pushbutton caps are supplied with an integral rubber seal which is permanently attached to the cap. See Figure 13.

**Seal Material:** The seal material is silicone rubber per ZZ-R-765. The surface has a black matte finish.

**Mounting Assembly:** Each sealed switch housing is supplied with a reversible mounting sleeve, a panel mounting spacer and a seal mounting flange, to complete the mounting assembly. The panel mounting spacer is used only when mounting in an edgelighted panel, otherwise discard.

**Mounting Cutout Dimensions:** See Figure 13.

**Installing Sealed Pushbutton Caps:** After the switch housing is properly mounted, the sealed pushbutton cap is installed by first pushing the cap all the way down to its fully retained position. To seal the cap onto the seal mounting flange, press a lower corner of the seal into the lower flange corner using firm finger pressure. Next press each of the three remaining corners of the seal into their respective flange corners. Follow by pressing each of the four sides into the seal mounting flange. The seal is then secured into the mounting flange by firmly pressing all previously pressed areas and smoothing any bulges by additional pressure. This will insure proper seal to mounting flange integrity.

**Enclosure Design:** When properly installed the sealing will meet the requirements for dripproof, watertight and splashproof sealed enclosure designs.

**Dripproof Sealing:** The sealed switches do not allow any leakage of water through the seal when subjected to the dripproof sealing test defined in MIL-S-22885D, paragraph 4.8.20.3 and MIL-STD-108.

**Watertight Sealing:** The sealed switches do not allow any leakage of water through the seal when subjected to the watertight sealing test defined in MIL-S-22885D, paragraph 4.8.20.2 and MIL-STD-108.

**Splashproof Sealing:** The sealed switches do not allow any leakage of water through the seal when subjected to the splashproof sealing test defined in MIL-S-22885D, paragraph 4.8.20.1 and MIL-STD-108.

**Sand and Dust:** The sealed switches meet the sand and dust test defined in MIL-S-22885D, paragraph 4.8.26.

**Operating Temperature:** The sealed switches are operational from -48°C (absolute minimum) to +85°C. For all endurance cycling tests -46°C ± 2°C must be substituted for -55°C ± 2°C.

**Front Lamp Replaceable:** Lamps are replaced from the front by lifting the corners of the seal out of the seal mounting flange. Each edge is then lifted and the cap extraction slots are grasped with fingernails and the cap is pulled from the housing. Lamps are then replaced and the pushbutton cap is reinstalled as explained above.

**High Impact Shock** (Option for sealed indicators and momentary action sealed switches only): When specified, the sealed indicators and momentary action sealed switches meet the high impact shock test defined in MIL-S-22885D, paragraph 4.8.16.2, Method II.

**FIGURE 11** Minimum contrast ratios and minimum Indexes of Discrimination for sunlight readable displays (Type S).

| Color | Color Code | Contrast Ratio | Index of Discrimination |
|---|---|---|---|
| RED | R | 0.6 | 2.0 |
| GREEN | G | 0.6 | 1.6 |
| YELLOW | Y | 0.6 | 1.6 |
| BLUE | B | 0.4 | 1.2 |
| WHITE | W | 0.6 | 1.2 |
| NVIS Green B | J | 0.6 | 1.6 |
| NVIS Yellow | K | 0.6 | 1.4 |

**FIGURE 12**

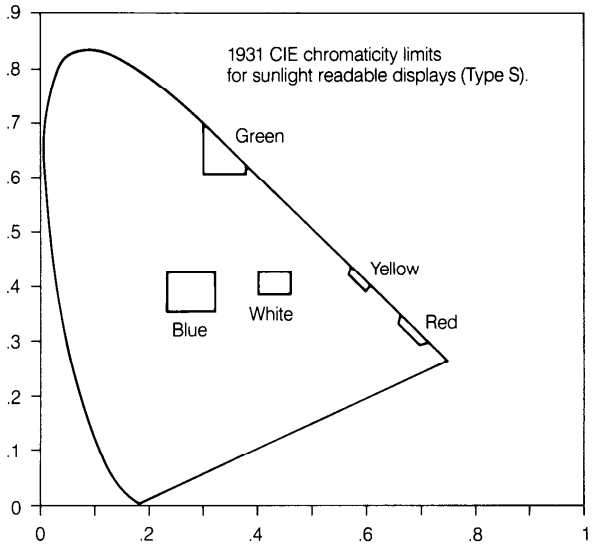
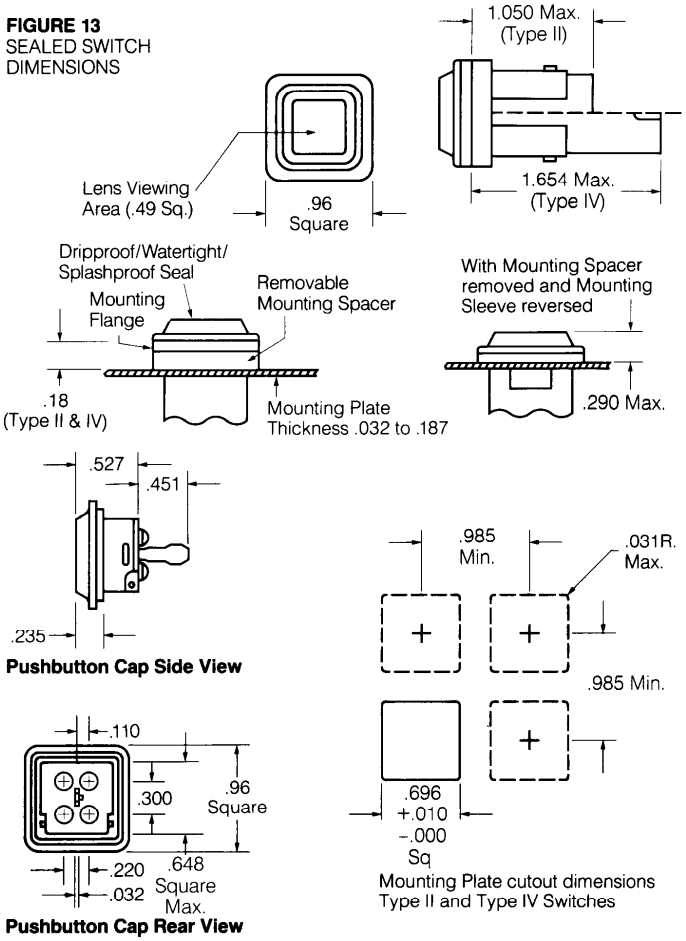



**FIGURE 13**
SEALED SWITCH DIMENSIONS



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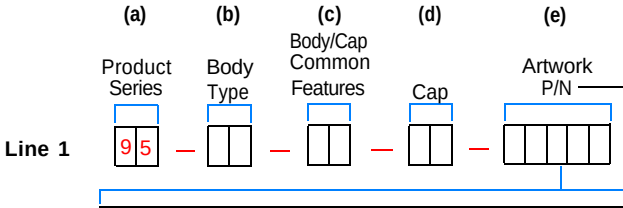
## HOW TO ORDER
## VIVISUN 20/20 SERIES 95




Switches and indicators are specified by a basic 13 digit part number which is comprised of (a) 2 digits to define the Aerospace Optics SERIES 95 product line, (b) 2 digits to define the switch body type, (c) 2 digits to define features that apply to both the switch body and pushbutton cap, (d) 2 digits to define the pushbutton cap, and (e) 5 digit artwork part number. Line 2 is provided to define the exact artwork used in the cap.

**Note:** Artwork 5 digit part number is assigned by Aerospace Optics to abbreviate and designate customer legend and color information specified on line 2.

Line 2 provides the detailed artwork description of legend position, color, character height and specific legends to be displayed with the corresponding legend position. When two or more legend positions (see Table 6) are to display information, a semicolon separates the legend information for each position. When two or more lines of characters (see Table 9) are to be used in one legend position, the individual lines are separated by a comma.

**To specify a Series 95 pushbutton switch or indicator, determine the basic part number as follows:**

**Step 1:** Select the desired type of switch termination from Table 1. Insert the appropriate designation number into the third position of the basic 13 digit part number.

**Step 2:** Select the desired switch poles and contact material from Table 2 and insert the appropriate designation number into the fourth position of the basic 13 digit part number.

**Step 3:** Select the desired enclosure design and EMI shielding option as listed in Table 3 and insert the appropriate designation number into the fifth position of the basic 13 digit part number.

**Step 4:** Select the pushbutton cap actuation and lamp circuit configuration from Table 4 and insert the designation number into the sixth position of the basic 13 digit part number.

**Step 5:** Select the desired pushbutton legend style from Table 5 and enter this letter into the seventh position of the 13 digit part number. The pushbutton lamp type as outlined in Table 7 should be placed into the eighth position of the part number.

**Step 6:** Complete the part number by using Tables 6, 8, 9 and the example on page 11.

**TABLE 1** Terminations

| Termination Type | Designation |
|---|---|
| **Solder Terminals** | |
| Turret | 1 |
| Spade | 2 |
| Wire wrap / PCB | 3 |
| **Solderless QUIK-CONNECT™** | |
| **Common Termination System (CTS)** | 4 |

Note: CTS designation number 4 is to order the switch/indicator portion only. The connector plug (QUIK-CONNECT™ module) is ordered separately for convenience to permit wiring harness manufacture without the necessity of the switch/indicator. The CTS connector plug is ordered as P/N 18-200. (See Ordering Example.)

**TABLE 2** Switch Poles and Contact Material

| Switch Poles | Contact Material: Silver | Contact Material: Gold Plate |
|---|---|---|
| SPDT-SB | 1 | 5 |
| DPDT-SB | 2 | 6 |
| SPDT-DB | 3 | 7 |
| DPDT-DB | 4 | 8 |
| Indicator | 0 | |

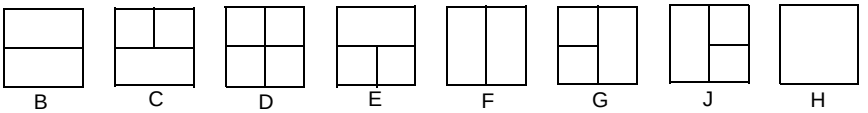
**TABLE 3** Enclosure Design and EMI

1 - Unsealed
2 - Dripproof / Watertight / Splashproof
3 - Dripproof, etc. with High Impact Shock
4 - Unsealed with EMI Shielding
5 - Dripproof, etc. with EMI Shielding
6 - Dripproof, etc. with High Impact Shock and EMI Shielding

**TABLE 4** Cap Actuation and Lamp Circuit

| Lamp Circuit | Actuation: Momentary | Actuation: Alternate | Actuation: Indicator |
|---|---|---|---|
| Common Ground | 1 | 4 | 7 |
| Split Ground Horizontal | 2 | 5 | 8 |
| Split Ground Vertical | 3 | 6 | 9 |

**TABLE 5** Pushbutton Legend Style



| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Standard Designation | B | C | D | E | F | G | J | H |
| NVG Designation | K | L | M | N | P | Q | R | S |

**TABLE 6** Legend Position

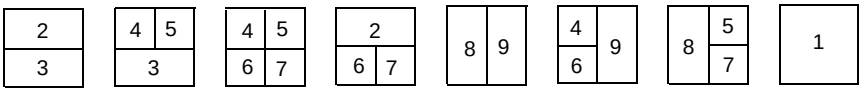



**TABLE 7** Lamp Style

| Type | Lamp P/N | Voltage | Current (amps) | Rated Life (hours) |
|---|---|---|---|---|
| 1 | 17-043 | 5 | .060 | 6,500 |
| 2 | 03-014* | 5 | .115 | 40,000 |
| 6 | 14-104** | 28 | .024 | 16,000 |

* MS-24515
* * MS-3338



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**TABLE 8**
Color

R- Red Y-Yellow G-Green
W-White B-Blue
J -NVIS green B
K-NVIS yellow

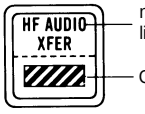
V-Visible white with blue white night legend lighting (Futura)
N-Visible white with red night legend lighting (Futura)
L-Visible white with NVIS green B night legend lighting (Futura)

**TABLE 9**
Character Capacity per Legend Position

| Character Size | Character Height | Lines/ Characters | Legend Position per Table 6 1 | 2-3 | 4-5-6-7 | 8-9 |
|---|---|---|---|---|---|---|
| 1* | .125 | **Lines Per Position** | **3** | **1** | **1** | **3** |
| | | Characters Per Line | 6 | 6 | 3 | 3 |
| 2* | .109 | **Lines Per Position** | **3** | **1** | **1** | **3** |
| | | Characters Per Line | 7 | **7** | **3** | **3** |
| 3 | .072 | **Lines Per Position** | **5** | **2** | **2** | **5** |
| | | Characters Per Line | 8 | 8 | 4 | 4 |
| 4 | .156 | **Lines Per Position** | **2** | **1** | **1** | **2** |
| | | Characters Per Line | 4 | **4** | **2** | **2** |

*Note: Visible white legends using Futura Medium Condensed lettering (Style V, N & L-per Table 8) have one less character per line for character sizes 1 and 2.

## EXAMPLE




Visible white with blue white night legend lighting

Green symbol

**1. How to order a typical VIVISUN 20/20 Series 95 switch having the following features:**

* Solderless Common Termination System (CTS)
* 2 poles (double break and gold plated contacts)
* Alternate action
* Split ground horizontal lamp circuit
* Low power 5 volt lamps (P/N 17-043)
* Legend Style B

**2. How to order QUIK-CONNECT™ plug and extraction tool for the Solderless Common Termination System (CTS)**

1. To order QUIK-CONNECT™ connector plug: 18-200
   Note: Connector will be supplied with sealing plugs.
2. To order extraction tool for removing the QUIK-CONNECT™ plug: 18-234 (18-234 replaces P/N 18-208).

**Note: This example requires ordering two separate components (switch and QUIK-CONNECT™ plug).**

**VIVISUN 20/20 Series 95**

**Terminations** (per Table 1) **Note** that Code 4 requires separate ordering of mating QUIK-CONNECT™ plug (see above order information for QUIK-CONNECT™)

**Switch Poles & Contact Material** (per Table 2)

**Enclosure & EMI** (per Table 3)

**Actuation & Lamp Circuit** (per Table 4)

**Pushbutton Legend Style** (per Table 5)

**Lamp Type** (per Table 7)

**Artwork Part Number** assigned by Aerospace Optics at time of customer request.

**Line 1:** 9 5 — 4 8 — 1 5 — B 1 — 5 0 3 8 8

**Line 2:** ( 2 V 3 H F A U D I O , X F E R ; 3 G O / / / / )

**Parenthesis** to start artwork description

**Legend position** per Table 6

**Color** per Table 8

**Character size** per Table 9

**Legend on first line** "HF AUDIO"

**Insert comma** between 1st and 2nd lines

**Legend on second line** "XFER"

**Insert semicolon** between legend positions

**Legend position** per Table 6

**Color** per Table 8

**Character size** per Table 9. **Note** that Code 0 designates non-standard symbols.

**Legend on first line "////"**

**Parenthesis** to denote end of artwork

**HOW TO ORDER SPARE COMPONENTS**

1. To order typical spare SERIES 95 VIVISUN 20/20 *pushbutton cap* only: (from example above)

   9 5 — X X — 1 5 — B 1 — 5 0 3 8 8

   Insert X's in body type spaces to denote push button cap only.
2. To order typical spare SERIES 95 VIVISUN 20/20 *body* only:

   9 5 — 4 8 — 1 5 (from example above)
3. To order spare *QUIK-CONNECT™ connector plugs* only: 18-200 (from example above)
4. To order typical spare *lamps* only: 17-043 (lamp type 1 from example above and Table 5)

**NOTE:** For repeat orders of the switch, only the 13 digit part number on line 1 is required.



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# VIVISUN SERIES 95™

**Only VIVISUN 20/20 Series 95 gives you all these important features:**

**Sunlight Readable**
Designed and qualified to MIL-S-22885/108.

**No Ghosting**
Maintains total dead face in direct sunlight when not energized.

**Dimmable for Low Level Readability**
Uniform brightness at reduced voltage levels. No hot spots.

**Night Vision Goggle Compatible Lighting**
Compatible with both NVIS and PVS-5A goggles.

**150° Viewing Angle Peripherally**
Widest in the industry.

**7 Sunlight Readable Colors**
Red, yellow, green, white, blue, NVIS green B, NVIS yellow.

**3 Visible White/Night Lighting Colors**
Blue-white, red, NVIS green B.

**Up to 4 Separate Messages per Single Unit**

**Low Touch Temperature**
Lowest in the industry.

**Low Power**
5 or 28 volt T-1 lamps.

**High Reliability**
100,000 cycles mechanical life.

**3 Lamp Circuits**
Common ground, horizontal split ground, or vertical split ground.

**Single Pole Double Throw or Double Pole Double Throw Switch Capacity**

**Momentary or Alternate Pushbutton Action**

**Versatile**
Pushbutton switch and/or indicator.

**Low Weight**
0.63 ounces (18 grams).

**Small Size**
.750″ x .750″ x 1.275.

**Solderless or Standard Solder Terminations**
QUIK-CONNECT™ turret, spade, or wire wrap/PCB.

**Quick and Easy Installation**
Individual units mounted from front of instrument panel.

**Easy Maintenance**
Lamps replaced from front without tools.

**Environmental Seal Option**
Dustproof, dripproof, watertight, splashproof.

**High Impact Shock Option**

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Data Sheet No. **95-1-86-3 REV 1**